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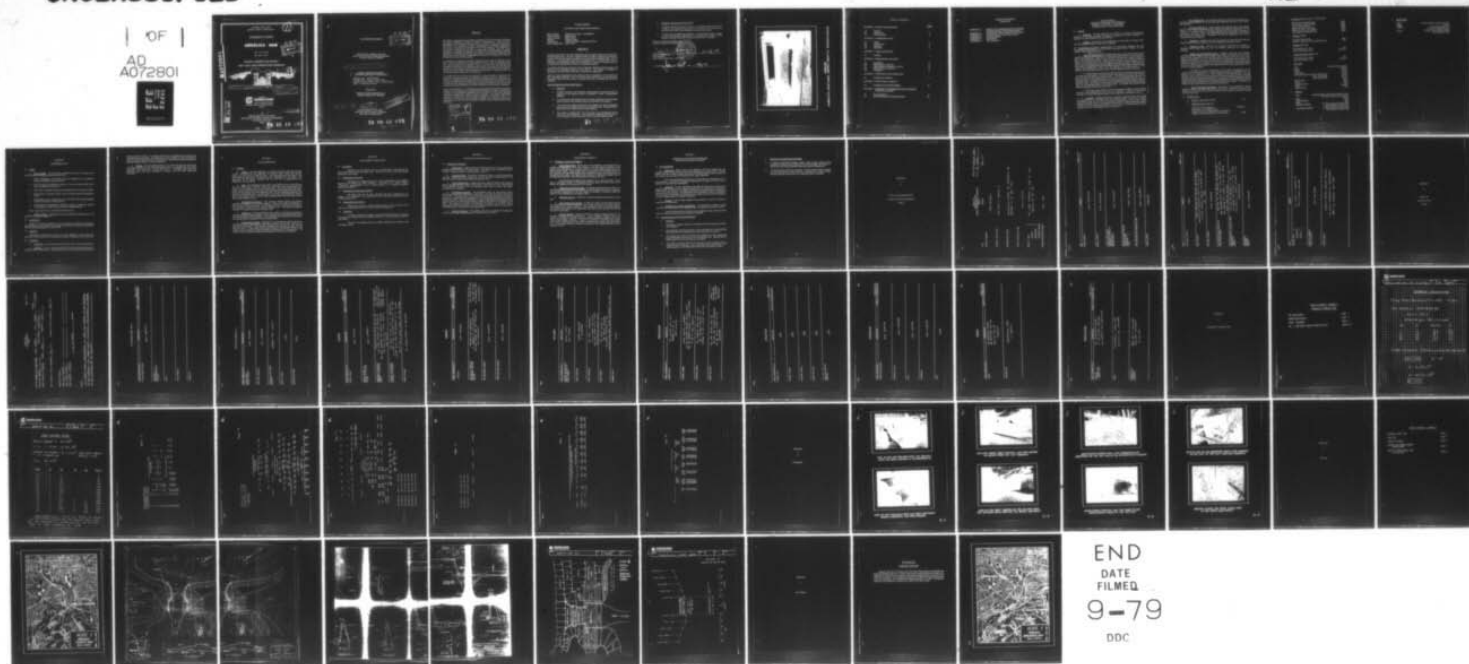
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NATIONAL DAM SAFETY PROGRAM. ANGELICA DAM. NDI-PA-00705. DA DER--ETC(U)
JUL 79

DACW31-79-C-0010

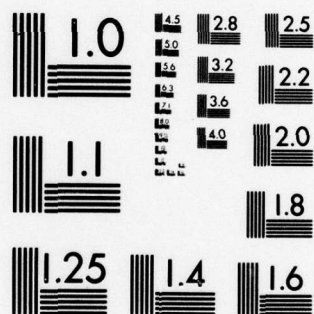
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DELAWARE RIVER BASIN
ANGELICA CREEK, BERKS COUNTY

(P.S.)

PENNSYLVANIA

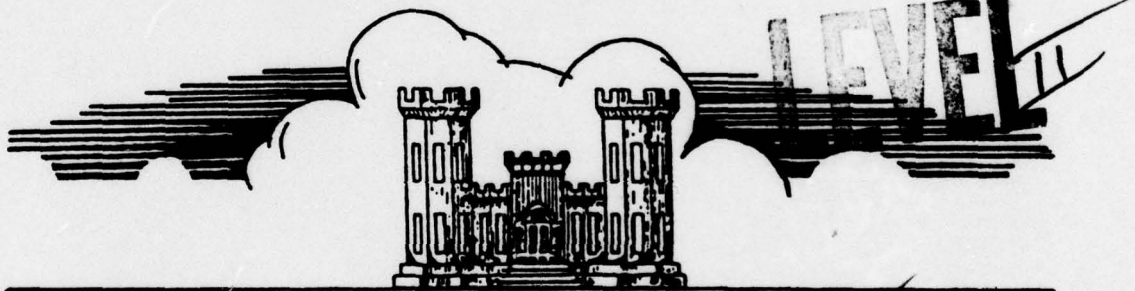
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PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



Contract #DACW31-79-C-0010

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Prepared By

O'BRIEN & GERE

Justin & Courtney Division
PHILADELPHIA, PENNSYLVANIA
19103

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FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

21203

JULY

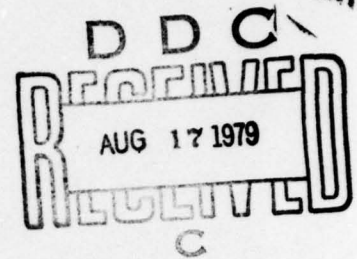
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DELAWARE RIVER BASIN



Name of Dam: Angelica Lake Dam
County & State: Berks County, Pennsylvania
Inventory Number: PA00705

(15) DACW 32-79-C-0024

(6) PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Angelica Dam. NDI-PA-00705.
DA DER-6-20. Delaware River Basin,
Angelica Creek, Berks County, Pennsylvania,
Phase I Inspection Report.

Prepared by:

O'BRIEN & GERE ENGINEERS, INC
JUSTIN & COURTNEY DIVISION

(11) JUL 79

For (12) 65P.

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DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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Justification	<i>Per file</i>
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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Angelica Lake Dam ID #PA00705
State Located: Pennsylvania
County Located: Berks County
Stream: Angelica Creek
Coordinates: Latitude 40° 18.7', Longitude 72° 55.4'
Date of Inspection: April 3, 1979

ASSESSMENT

Angelica Lake Dam is an earth embankment with a masonry wall on the left side of the downstream face. The dam is approximately 140 feet in length with a maximum height of 30 feet and impounds a reservoir with a normal pool storage capacity of 147 acre-feet. A broad-crested concrete drop spillway with a 39-foot crest length is located at the longitudinal center of the embankment. The dam is owned by the City of Reading and the reservoir is used for recreational purposes.

The Spillway Design Flood chosen for this "Small" size, "Significant" hazard dam is 50 percent of the Probable Maximum Flood (PMF). The spillway is capable of discharging 32 percent of the PMF and is classified as "Inadequate".

Based on visual observations made during the date of inspection and the review of the information obtained from the Pennsylvania Department of Environmental Resources, Division of Dam Safety, Angelica Lake Dam is considered to be in fair condition.

Recommendations and Remedial Measures

a. Facilities

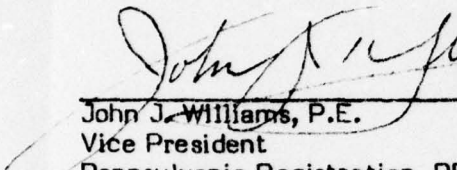
1. Detailed hydrologic and hydraulic studies should be performed and the capacity of the spillway should be increased to make it hydraulically adequate.
2. The eroded and undermined areas on the crest adjacent to the footbridge should be filled with compacted earth and resurfaced with asphalt.
3. The eroded area along the 18-inch pipe beneath the right downstream bridge abutment should be filled with compacted earth. Riprap should be placed around the pipe to prevent future erosion.
4. The masonry retaining wall on the left side of the downstream face is overgrown with vegetation. This overgrowth should be removed and a closer inspection of the downstream face of the wall should be made.

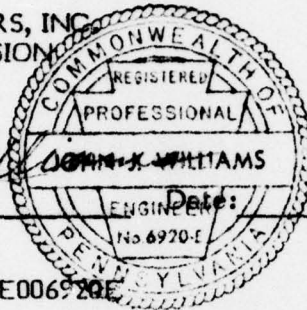
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b. Operation and Maintenance Procedures

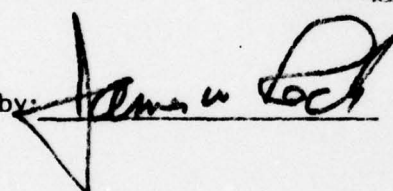
1. A regular maintenance program should be established which would include cutting of the embankment grass, periodic operation of the sluice gate, and removal of debris from the spillway approach apron area.
2. A warning system should be developed. During periods of heavy rainfall, the dam and highway bridge should be monitored and highway traffic should be alerted in the event of an impending failure of the dam.

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JUSTIN & COURTNEY DIVISION

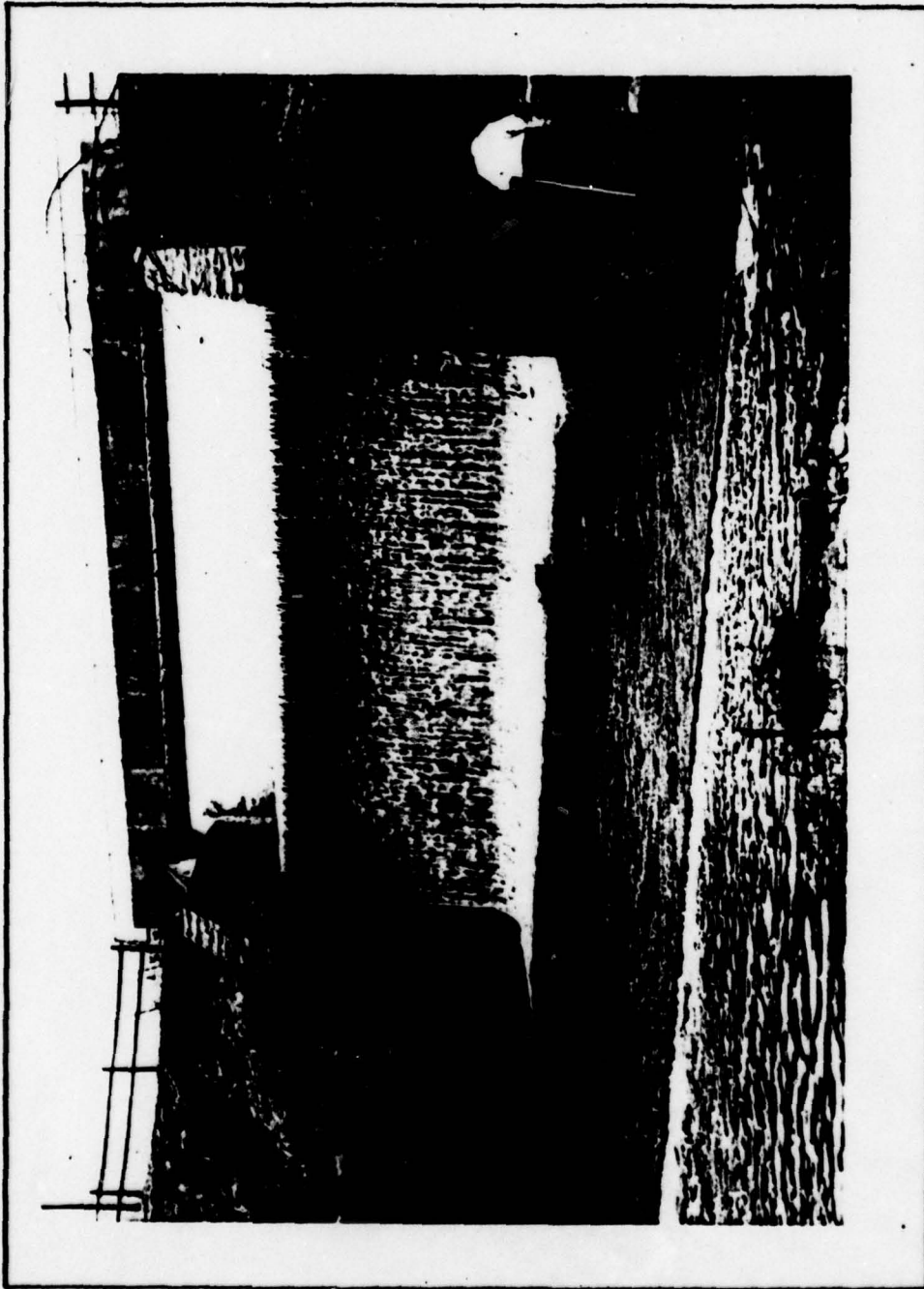

John J. Williams, P.E.
Vice President
Pennsylvania Registration PE006920E



20 July '79

Approved by: 

Date: 1 Aug 79



*OVERVIEW
ANGELICA LAKE DAM, BERKS COUNTY, PENNSYLVANIA*

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
ANGELICA LAKE DAM ID #PA00705
SECTION 1 PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if Angelica Lake Dam constitutes a hazard to human life or property.

1.2 Description of Project (Supplemented by information obtained from the Pennsylvania Department of Environmental Resources (DER), Division of Dam Safety, Harrisburg, Pennsylvania)

Abstract
a. Dam and Appurtenances. Angelica Lake Dam is an earth structure with a masonry retaining wall along the left side (looking downstream) of the downstream face. The embankment is approximately 140 feet in length with a maximum height of 30 feet and a 35-foot top width. A road is built on the crest of the dam at Elevation 228.0. The upstream face of the embankment is variable in slope, ranging from 2.5 horizontal to 1 vertical (2.5H:1V) between Elevations 203.0 and 213.0 to 1.5H:1V between Elevations 213.0 and 223.0 to 10H:1V between Elevations 223.0 and 228.0. The downstream slope of the embankment is 2H:1V from the spillway to the right abutment. The masonry wall forms the downstream face from the spillway to the left abutment.

→ A broad-crested concrete drop spillway with stone masonry training walls is located near the center of the embankment. The spillway crest is 39 feet wide and has a 25-foot long concrete approach apron. The crest and approach apron are at Elevation 213.0. The spillway drop is 15 feet to a downstream concrete apron at Elevation 198.0. The apron is 52 feet long and directs flow into the outlet channel at Elevation 196.0. The masonry training walls extend from the entrance to the approach apron to the discharge point of the outlet apron. A concrete foot bridge crosses above the spillway crest at Elevation 222.0.

→ The outlet works consist of a 20-inch diameter wrought iron pipe through the base of the embankment to the left of the spillway. Control of the pipe is provided by a sluice gate approximately 20 feet upstream of the spillway crest. *15701*

b. Location. Angelica Lake Dam is located on Angelica Creek about 1,000 feet upstream of its confluence with the Schuylkill River. The dam is situated immediately south of the City of Reading, Pennsylvania and lies within Cumru Township in Berks County. The dam site is shown on the USGS Quadrangle entitled, "Reading, PA.", at coordinates N 40° 18.7', W 72° 55.4'. A regional location plan of Angelica Lake Dam is enclosed as Plate 1, Appendix E.

c. Size Classification. The maximum height of 30 feet and an approximate maximum storage capacity of 530 acre-feet place Angelica Lake Dam in the "Small" size category.

d. Hazard Classification. A dam failure could cause damage to, and possible failure of, the highway bridge abutments located immediately downstream of the structure. An access road to a sewage treatment plant downstream could also be washed out. However, there are no inhabitable structures susceptible to damage in the downstream danger area. Therefore, the dam is considered to be in the "Significant" hazard category.

e. Ownership. Angelica Lake Dam is owned by the Department of Parks and Public Property, City of Reading, City Hall, Reading, Pennsylvania, 17120.

f. Purpose of Dam. The dam was originally constructed to impound an industrial water supply reservoir, but it is currently used only for recreational purposes.

g. Design and Construction History. Angelica Lake Dam was originally constructed by the Angelica Water Company about 1885. In 1902 the failure of a dam approximately one-quarter mile upstream caused Angelica Lake Dam to be overtopped and breached. The dam was repaired by the Reading Cold Storage & Ice Company, who owned the structure at that time. Although the owners consulted with William H. Dechant, C.E., Engineering & Surveying, Reading, PA., concerning repairs to the dam, they closed the breach according to their own ideas, ignoring the advice of their consulting engineer.

By 1940, the severe deterioration of the timber crib spillway and the acquisition of the dam by the City of Reading brought about the reconstruction of the spillway and the installation of a water supply line and blow-off pipe. The new spillway, outlet works, and water supply conduit were designed by City of Reading engineers and were constructed during 1941. A segment of the left spillway training wall and portions of the upstream and downstream concrete aprons were removed and replaced with new construction in 1973 (following Hurricane Agnes). A concrete foot bridge was also constructed over the spillway at this time.

h. Normal Operating Procedures. Drawdown of the reservoir is accomplished by opening the sluice gate of the outlet works. There is no record of any operation of the outlet works since 1973 when some masonry and concrete sections were reconstructed.

1.3 Pertinent Data.

a. <u>Drainage Area</u> (Square miles)	7.5
b. <u>Discharge at Dam Site</u> (cfs)	
Maximum Flood of Record (according to Mr. Robert Masley Construction Superintendent, City of Reading)	630 (EST.)
Spillway discharge, reservoir at crest of dam	3,264

c. Elevation (feet above MSL - USGS Datum)

Spillway Crest (Normal Pool)	213.0
Top of Dam at Spillway Walls	222.0
Top of Dam, Maximum	228.0
Reservoir Drain Invert (inlet)	202.0
Reservoir Drain invert (outlet)	199.0
Streambed at Downstream Toe	198.0

d. Reservoir (Miles)

Length of Normal Pool	0.27
Length of Maximum Non-overtopping Pool	0.44

e. Storage (acre-feet)

Normal Pool, Elev. 213.0	147
Top of Dam, Elev. 222.0	530 (EST.)

f. Reservoir Surface Area (acres)

Normal Pool, Elev. 213.0	22.5
Top of Dam, Elev. 222.0	65 (EST.)

g. Dam Data

Type	Earth and stone masonry
Length	140 feet
Height	30 feet
Crest Width	35 feet
Side Slopes (upstream), Elev. 203.0-213.0	2.5H:1V
Elev. 213.0-223.0	1.5H:1V
Elev. 223.0-228.0	10H:1V
(downstream)	2H:1V
Zoning	None
Impervious Core	None
Cutoff	Unknown
Grout Curtain	None

h. Spillway

Type	Broad-crested concrete drop spillway section with stone masonry training walls.
Width	39 feet
Crest Elevation	213.0
Gates	None
Upstream Channel	25-foot long concrete apron with stone masonry training walls.
Downstream Channel	52-foot long concrete apron with stone masonry training walls.

i. Outlet Works

Type
Length
Closure

Access

20-inch diameter wrought iron pipe.
110 feet

Gate control adjacent to
the upstream spillway apron.

The gate control shaft is located
on the upstream face.

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. The information available for review of Angelica Lake Dam includes the following obtained from the DER:

1. Permit, Application, and Report Upon the Application to reconstruct portions of Angelica Lake Dam, 1940.
2. Plan and Section drawings for repairs to the dam breach (1902), which were not followed by the Owner.
3. Plan of dam and design drawings for reconstruction of the spillway (1939).
4. Plan drawing of proposed masonry wall and concrete apron reconstruction (1972).
5. Photographic series covering the years 1913-1970 and including progress photos of the spillway reconstruction.
6. Miscellaneous correspondence, inspection reports, construction reports etc., located in the DER main office files in Harrisburg, Pa.

Note: Design data was not available for this structure.

b. Design Features. The design features are described in Section 1.2.a. and shown on the Plates in Appendix E.

2.2 Construction

Based on the field investigation and the information available in the construction reports, the dam appears to have been reconstructed in general conformance with the design drawings from 1939 and 1972.

2.3 Operation

Operational procedures are limited to those necessary to draw down the reservoir by means of the control gate located beneath the upstream face of the dam.

2.4 Evaluation

- a. Availability. The information utilized in this report was provided by DER.
- b. Adequacy. The dam was built around 1885 and there are no records of the original design or construction. Design drawings from the reconstruction periods in

1940 and 1973 are limited. Few design calculations are available and no embankment cross-sections are provided. The information made available by DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Validity. The elevations provided on the design drawings are inconsistent with those indicated on the USGS Quadrangle Sheet. It appears that the design elevations were referenced to some local datum. Throughout this report the elevations given have been converted to conform with the USGS Quadrangle Elevations.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Angelica Lake Dam took place on April 3, 1979. At the time of the inspection, the reservoir water surface was approximately one inch above the spillway crest. The observations and comments of the field inspection team are in the checklist which is Appendix B of this report. The appearance of the facility indicates that the dam and its appurtenances are maintained in fair condition.

b. Dam. The embankment and masonry wall appear to be in fair condition. The crest of the dam is slightly eroded and undermined where the concrete foot bridge over the spillway ties into the embankment. Significant erosion has taken place around an 18-inch diameter pipe which extends from the right abutment downstream of the spillway near the bridge abutment. This pipe apparently provides road drainage and the pipe outlet is located about 9 feet above the downstream spillway apron. The masonry wall is overgrown with vegetation and brush which could conceal any seepage through the wall.

c. Appurtenant Structures. The concrete spillway, aprons and masonry training walls appear to be in good condition. There are no signs of instability or deterioration of these structures. The discharge end of the outlet pipe is located in the downstream face of the left spillway training wall. This pipe was originally connected to a powerhouse which no longer exists.

d. Reservoir. Area reconnaissance of the reservoir disclosed no evidence of excessive siltation, slope instability, or other features that would significantly affect the storage capacity of the reservoir. The slopes along the perimeter of the reservoir are vegetated and on gradients of less than ten percent.

e. Downstream Channel. Discharge in the downstream channel flows into the Schuylkill River approximately 1,000 feet downstream of the dam. There are no inhabitable structures in the potential damage area between the dam and the Schuylkill River. A dam failure could cause damage to, and possible failure of, the highway bridge abutments located immediately downstream of the structure. The access road to a sewage treatment plant downstream could also be washed out.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Drawdown of the reservoir may be accomplished by operation of the sluice gate which controls the outlet pipe. There are no other known operational procedures for this dam.

4.2 Maintenance of the Dam

Maintenance of Angelica Lake Dam is the responsibility of the Reading Department of Parks and Public Property. According to Mr. Robert Masley, Construction Superintendent, City of Reading, there is no regularly scheduled maintenance program.

4.3 Maintenance of Operating Facilities

The sluice gate has not been operated since 1973, according to Mr. Masley. It is not known if any maintenance to the operating facilities has been performed since 1973.

4.4 Warning Systems in Effect

There is no need for a formal warning system for this structure since there are no inhabitable structures in the downstream damage area.

4.5 Evaluation

A regular maintenance program, which would include cutting of the grass and weeds on a regular basis and periodic operation of the sluice gate, should be established.

The dam is accessible under all weather conditions for inspection and emergency action.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. Angelica Lake has a drainage area of 7.5 square miles and a surface area of 22.5 acres at normal pool. The 39-foot wide drop spillway has a maximum discharge capacity of approximately 3,260 cfs.

b. Experience Data. No records of reservoir level or rainfall are kept for this dam. According to Mr. Masley, the reservoir elevation reached about 3 feet above the spillway crest during Hurricane Agnes in 1972.

c. Visual Observations. Several logs were observed blocking the upstream edge of the approach apron which could result in constriction of flow. Debris should be periodically removed from the upstream apron area to insure the proper functioning of the spillway.

d. Overtopping Potential. The established range for the Spillway Design Flood for a "Small" size, "Significant" hazard dam is the 100-year flood to 50 percent of the PMF. Although there are no inhabitable structures downstream, the dam is located in an urban area and the possibility of future development of the downstream area exists. There is also the potential for damage of the downstream bridge and access road; therefore the recommended Spillway Design Flood (SDF) is 50 percent of the PMF. The spillway is capable of discharging 32 percent of the PMF without overtopping of the embankment. The peak inflow and outflow rates for 50 percent of the PMF are 5,751 cfs. and 5,343 cfs., respectively.

e. Spillway Adequacy. The Angelica Lake Dam is classified as "Inadequate" since it is not capable of passing the SDF (50 percent of the PMF).

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. On the date of the inspection, the embankment and masonry wall appeared to be in fair condition. The only apparent problem is the erosion that was observed on the dam crest at the foot bridge junction and on the right abutment slope. These eroded areas do not present any immediate hazard to the structure, but continued erosion could potentially weaken the embankment and damage the foot bridge. The masonry wall could not be examined thoroughly due to the vegetation and brush which has overgrown the face of the wall.

The spillway and training walls appear to be in good condition. Minor surface cracking is evident in the upstream training walls, but these cracks do not affect the integrity of the structure in any manner.

b. Design and Construction Data. The design drawings and data contain no information as to the nature of the embankment and foundation materials. Permeability and strength characteristics, and unit weights are necessary to properly assess the stability of the embankment and masonry walls.

c. Operating Records. There are no official operating records kept for this dam.

d. Post-Construction Changes. In 1940, the timber crib and earth structure was modified to an earth embankment with masonry walls and the timber spillway was replaced by a concrete spillway. The powerhouse which was *originally* located immediately downstream of the embankment was razed at some unknown time during the history of the dam.

e. Seismic Stability. Angelica Lake Dam is located in Seismic Zone 1 on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is generally considered to be safe under any expected earthquake loading if it is stable under static loading conditions. However, it should be noted that three minor tremors have occurred since 1954, which originated within sixteen miles of the dam site. These tremors have been classified according to the Modified Mercalli Scale as intensity V or VI.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Evaluation. Based on the visual inspection, the earth embankment and masonry wall on the downstream face are considered to be in fair condition. Several eroded areas are in need of repair and should be protected against future erosion and the masonry wall is in need of maintenance and closer inspection.

The concrete spillway and masonry training walls are considered to be in good condition. The spillway is capable of passing only 32 percent of the PMF and is classified as hydraulically "Inadequate".

b. Adequacy. The dam was built around 1885 and there are no records of the original design or construction. Design drawings from the reconstruction periods in 1940 and 1973 are limited. Few design calculations are available and no embankment cross-sections are provided. The information made available by DER, conversations with the Owner's representative and observations made during the field investigation provided adequate data for a Phase I evaluation.

c. Urgency. The remedial measures recommended in Section 7.2 should be implemented immediately.

d. Necessity for Further Investigation. The downstream masonry training wall should be investigated more thoroughly after the vegetation has been removed.

Detailed hydrologic and hydraulic studies should be made to determine the extent to which the spillway capacity should be increased.

7.2 Recommendations and Remedial Measures

a. Facilities

1. The spillway capacity should be increased so that the spillway is hydraulically adequate.
2. The eroded and undermined areas on the crest adjacent to the footbridge should be filled with compacted earth and resurfaced with asphalt.
3. The eroded area along the 18-inch pipe beneath the right downstream bridge abutment should be filled with compacted earth. Riprap should be placed around the pipe to prevent future erosion.
4. The masonry retaining wall on the left side of the downstream face is overgrown with vegetation. This overgrowth should be removed and a closer inspection of the downstream face of the wall should be made.

b. Operation and Maintenance Procedures

1. A regular maintenance program, which would include cutting of the embankment grass, periodic operation of the sluice gate, and removal of debris from the spillway approach apron area should be established.
2. A warning system should be developed. During periods of heavy rainfall, the dam and highway bridge should be monitored and highway traffic should be alerted in the event of an impending failure of the dam.

APPENDIX

A

Check List Engineering Data
Design, Construction, Operation
Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM ANGELICA LAKE

ID # PA 00705

Sheet 1 of 4

ITEM

REMARKS

AS-BUILT DRAWINGS

NONE AVAILABLE

REGIONAL VICINITY MAP

SEE PLATE 1, APPENDIX E

CONSTRUCTION HISTORY

CONSTRUCTION REPORTS AND PHOTOGRAPHS ARE
AVAILABLE IN THE DER FILES

TYPICAL SECTIONS OF DAM

NONE AVAILABLE

OUTLETS - PLAN

DETAILS

CONSTRAINTS

DISCHARGE RATINGS

RAINFALL/RESERVOIR RECORDS

THE OUTLET ALIGNMENT IS SHOWN ON PLAN
DRAWINGS OF THE DAM

NONE KEPT

ITEM	REMARKS
DESIGN REPORTS	NONE AVAILABLE
GEOLOGY REPORTS	NONE AVAILABLE
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	NONE AVAILABLE
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	NONE AVAILABLE
POST-CONSTRUCTION SURVEYS OF DAM	NONE AVAILABLE
BORROW SOURCES	UNKNOWN

ITEM	REMARKS
MONITORING SYSTEMS	NONE
MODIFICATIONS	<p>AMPLE REPORTS AND DRAWINGS ARE AVAILABLE DETAILING THE MODIFICATIONS MADE TO THE DAM IN 1940. A PLAN DRAWING INDICATES THE REPAIRS MADE IN 1973.</p>
HIGH POOL RECORDS	NONE AVAILABLE
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	<p>DRAWINGS BY THE DECHANT ENGINEERING CO. ARE AVAILABLE FROM 1902 WHICH DETAIL PLANS FOR THE CLOSURE OF A BREACH IN THE DAM. THESE PLANS WERE NOT UTILIZED.</p>
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	<p>THE DAM WAS BREACHED IN 1902, BUT NO REPORTS ARE AVAILABLE ON THE SUBJECT. THE BREACHING IS BRIEFLY DESCRIBED IN THE CORRESPONDENCE.</p>
MAINTENANCE OPERATION RECORDS	NONE AVAILABLE

ITEM	REMARKS
<div> <div>SPILLWAY PLAN</div> <div> <div>SECTIONS</div> <div>DETAILS</div> </div> </div>	<p>SEE PLATES IN APPENDIX E FOR AVAILABLE DRAWINGS.</p>
<div>OPERATING EQUIPMENT PLANS & DETAILS</div>	<p>NONE AVAILABLE</p>
<div>MISCELLANEOUS</div>	<p>INSPECTION REPORTS, DRAWDOWN REQUESTS, AND VARIOUS MEMORANDA AND CORRESPONDENCE WERE ALSO AVAILABLE FROM DER.</p>

APPENDIX

B

Check List
Visual Inspection
Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Sheet 1 of 11

Name Dam ANGELICA LAKE DAM County BERKS State PENNA. National ID # PA 00705
Type of Dam EARTH Hazard Category SIGNIFICANT
Date(s) Inspection 4/3/79 Weather RAINY Temperature 45°

Pool Elevation at Time of Inspection 213 M.S.L. Tailwater at Time of Inspection 196 M.S.L.

Inspection Personnel:

MR. LEE DEHEER

MR. STEVE SNIDER

MR. ROBERT BOWERS

MR. LEE DEHEER Recorder

Remarks:

MR. ROBERT WOLFE, SUPERINTENDENT OF PARKS, WAS PRESENT AT THE BEGINNING
OF THE INSPECTION; MR. ROBERT MASLEY, CONSTRUCTION SUPERINTENDENT, WAS PRESENT
AT THE CONCLUSION OF THE INSPECTION.

DOWNSTREAM MASONRY WALL

Sheet 2 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

ANY NOTICEABLE SEEPAGE

NONE OBSERVED

STRUCTURE TO
ABUTMENT/EMBANKMENT
JUNCTIONS

DRAINS

WATER PASSAGES

FOUNDATION

DOWNSTREAM MASONRY WALL

Sheet 3 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	NONE OBSERVED	
STRUCTURAL CRACKING	NONE OBSERVED	
VERTICAL AND HORIZONTAL ALIGNMENT	APPEARED FAIRLY STRAIGHT	
MONOLITH JOINTS	NONE	
CONSTRUCTION JOINTS	NONE	

EMBANKMENT

Sheet 4 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

SURFACE CRACKS

NONE OBSERVED

UNUSUAL MOVEMENT OR
CRACKING AT OR BEYOND
THE TOE

NONE OBSERVED

SLOUGHING OR EROSION OF
EMBANKMENT AND ABUTMENT
SLOPES

EROSION OF THE TOP OF DAM AT THE
FOOT BRIDGE JUNCTION AND EROSION OF
THE RIGHT ABUTMENT SLOPE AROUND A DRAINAGE
PIPE NEAR THE RIGHT BRIDGE ABUTMENT
WAS EVIDENT.

THE ERODED AREAS
SHOULD BE FILLED WITH
COMPACTED EARTH AND
PROTECTED FROM
FURTHER EROSION.

VERTICAL AND HORIZONTAL
ALIGNMENT OF THE CREST

THE CREST OF THE DAM IS TRAPEZOIDAL
IN SHAPE IN THE LONGITUDINAL DIRECTION. THE CREST
SLOPES DOWN FROM THE ABUTMENTS TO ITS LOWEST
POINT AND IS LEVEL ACROSS THE FOOT BRIDGE.

RIPRAP FAILURES

NO RIPRAP APPARENT ON STRUCTURE

EMBANKMENT

Sheet 5 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
-----------------------	--------------	----------------------------

DRAINS

NONE OBSERVED

JUNCTION OF EMBANKMENT
AND ABUTMENT, SPILLWAY
AND DAM

EROSION AND UNDERMINING
IS APPARENT AT THE JUNCTIONS OF
THE FOOT BRIDGE OVER THE SPILLWAY AND
THE EMBANKMENT.

THE ERODED SECTIONS
SHOULD BE FILLED
WITH COMPACTED EARTH
AND RESURFACED.

ANY NOTICEABLE SEEPAGE

NONE OBSERVED

STAFF GAGE AND RECORDER

NONE OBSERVED

OUTLET WORKS

Sheet 6 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	OUTLET CONDUIT NOT VISIBLE	
INTAKE STRUCTURE	INTAKE STRUCTURE IS SUBMERGED	
OUTLET STRUCTURE	THE PIPE IS OPEN-ENDED AT ITS OUTLET. THE OUTLET WAS ONCE LOCATED IN THE POWER HOUSE WHICH NO LONGER EXISTS.	
OUTLET CHANNEL	THE OUTLET CHANNEL IS THE NATURAL STREAMBED. THE CHANNEL TERMINATES AT THE SCHUYLKILL RIVER ABOUT 1000 FEET DOWNSTREAM OF THE DAM.	
EMERGENCY GATE	NONE	

UNGATED SPILLWAY

Sheet 7 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE WEIR	THE CONCRETE WEIR SECTION APPEARS TO BE IN GOOD CONDITION.	
APPROACH CHANNEL	MINOR CRACKING IS APPARENT ON THE UPSTREAM MASONRY TRAINING WALLS, BUT THE APPROACH CHANNEL IN GENERAL APPEARS TO BE IN GOOD CONDITION.	
DISCHARGE CHANNEL	THE CONCRETE APRON WHICH FORMS THE DISCHARGE CHANNEL ALSO APPEARS TO BE IN GOOD CONDITION.	
BRIDGE AND PIERS	THE FOOT BRIDGE OVER THE SPILLWAY WAS SLIGHTLY UNDERMINED AT ITS TIE-IN POINTS ON THE EMBANKMENT.	REPAIR IS RECOMMENDED AS DESCRIBED PREVIOUSLY.

GATED SPILLWAY

Sheet 8 of 11

<u>VISUAL EXAMINATION OF</u>	<u>OBSERVATIONS</u>	<u>REMARKS OR RECOMMENDATIONS</u>
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

Sheet 9 of 11

VISUAL EXAMINATION OBSERVATIONS REMARKS OR RECOMMENDATIONS

MONUMENTATION/SURVEYS

NONE OBSERVED

OBSERVATION WELLS

NONE OBSERVED

WEIRS

NONE OBSERVED

PIEZOMETERS

NONE OBSERVED

OTHER

NONE

RESERVOIR

Sheet 10 of 11

REMARKS OR RECOMMENDATIONS

OBSERVATIONS

VISUAL EXAMINATION OF

SLOPES

THE RESERVOIR SLOPES
ARE RELATIVELY FLAT AND
SHOW NO SIGNS OF
INSTABILITY.

SEDIMENTATION

SEDIMENTATION LEVEL
IS UNKNOWN

DOWNSTREAM CHANNEL

Sheet 11 of 11

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	THE DOWNSTREAM CHANNEL IS THE NATURAL STREAMBED AND APPEARS TO BE UNOBSTRUCTED.	
SLOPES	DOWNSTREAM SLOPES ARE MILD AND WELL VEGETATED	
APPROXIMATE NO. OF HOMES AND POPULATION	THERE ARE NO INHABITABLE STRUCTURES DOWNSTREAM OF THE DAM.	

APPENDIX

C

Hydrologic & Hydraulic Data

TABLE OF CONTENTS - APPENDIX C

HYDROLOGIC & HYDRAULIC DATA

PMP CALCULATIONS	SHEET 1
SNYDER COEFFICIENTS	SHEET 1
STAGE - DISCHARGE	SHEET 2
HEC - 1 DAM SAFETY VERSION COMPUTER OUTPUT	SHEETS 3-8

HYDROLOGY CALCULATIONS

Drainage Basin, (Area planimetered from USGS) = 7.5 sq. mi.

PMP Calculations (HMS REPORT 33)

Area is in Zone 6.

∴ 24-hour, 200 sq. mile PMP = 23.5 inches

HR.	%	RAINFALL	Δ
6	113	26.6	26.6
12	123	28.9	2.3
24	132	31.0	1.1
48	142	33.4	2.4

SNYDER COEFFICIENTS (information provided by Balt. COE, Area 6)

$$C_p = 0.40$$

$$C_t = 1.35$$

$$t_p = C_t (LL_{100})^{0.3}$$

$$t_p = 1.35 [5.4 (2.7)]^{0.3}$$

$$t_p = 3.0$$



O'BRIEN & GERE

SUBJECT

ANGELICA LAKE DAM

SHEET

2

BY

RRB

DATE

JOB NO.

STAGE - DISCHARGE VALUESSPILLWAY DISCHARGE $\rightarrow Q_s = CLH_s^{3/2}$ $C = 3.1$, $L = 39$ FEET, $Q_s = 120.9 H_s^{3/2}$ OVERTOPPED DAM DISCHARGE $\rightarrow Q_o = 2.3 Z H_o^{2.5}$
FOR A TRIANGULAR WEIR(OPEN-CHANNEL HYDRAULICS,
VENTE CHOW, P. 81) $Z = 20$, $Q_o = 46 H_o^{2.5}$

<u>ELEV.</u>	<u>H_s</u>	<u>Q_s</u>	<u>H_o</u>	<u>Q_o</u>	<u>Q_{TOTAL}</u>
213	0	0			0
214	1	121			121
215	2	342			342
216	3	628			628
217	4	967			967
218	5	1352			1352
219	6	1777			1777
220	7	2239			2239
221	8	2736			2736
222	9	3264	0	0	3264
223	10	3823	1	46	3869
224	11	4411	2	260	4671
225	12	5026	3	717	5743
226	13	5667	4	1472	7139

STAGE-STORAGE VALUES \rightarrow NORMAL POOL STORAGE WAS CONTAINED IN THE INFORMATION OBTAINED FROM DER. FOR ELEVATIONS 220 AND 240, AREAS WERE PLANIMETERED FROM THE USGS QUAD SHEET AND THE CONIC METHOD OF STORAGE DIFFERENTIALS WAS APPLIED.

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAY SAFETY VERSION JULY 1975

LAST MODIFICATION: 25 SEP 78

[illegible]

.....
 ELONG HYDROGRAPH (PCE-1)
 DAM SAFETY VERIFICATION JULY 1976
 LAST MODIFICATION 25 SEP 76

RUN DATE 04/06/77
 TIME 08.30.12

NATIONAL DAM INSPECTION PROGRAM
 ANGELICA LAKE DAM
 PMF HYDROGRAPH

JOB SPECIFICATION									
NU	NHR	NMIN	ICDP	IMIN	METRC	IPLT	IPRT	INSTAN	
170	0	30	0	0	0	0	-4	0	
			JCDP	NAT	LEOPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
 NPLAN= 1 NRATIO= 1 LRATIO= 1

RTIOS=	.20	.30	.40	.50	.60	.70	.80	.90	1.00
--------	-----	-----	-----	-----	-----	-----	-----	-----	------

SUB-AREA WUNOFF COMPUTATION

RUNOFF TO ANGELICA LAKE

ISTAD	ICDP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLOW	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IMYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	7.50	0.00	7.50	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .000

LOSS DATA

LRUPT	STK2	DLTK	RTIO	ERAIN	STK3	RTIOK	STPL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 3.00 CP= .00 NTA= 0

RECESSION DATA

STRIO= -1.50 QRCST= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 63 END-OF-PERIOD ORIGINATES, LAG= 3.01 HOURS, CP= .40 VOL= 1.00									
37.	130.	283.	439.	569.	644.	644.	595.	544.	497.
454.	415.	379.	347.	317.	290.	265.	247.	221.	202.
185.	164.	155.	141.	129.	118.	108.	99.	90.	82.
75	60	45	30	15	0	0	0	0	0

SHEET 5

12. 31.	11. 26.	10. 23.	9. 21.	8. 20.	7. 18.	6. 15.	5. 14.
12. 5.	11. 5.	10. 4.	9. 4.	8. 4.	7. 4.	6. 4.	5. 4.

END-OF-PERIOD FLOW
 MO.DA HR.MN PERIOD RAIN EXCS LOSS COMP Q
 SUM 26.70 24.30 2.40 235952.
 (678.1) (617.1) (61.1) (6661.42)

HYDROGRAPH ROUTING

ROUTING THROUGH ANGELICA LAKE

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGF	IAUTO
OUTFLO	1	0	0	0	0	1	0	0
2LOSS	0.00	AVG	IRSE	ISAM	IOPT	IPMP	LSTR	0
0.0	0.00	0.00	1	1	0	0	0	0
NSTPS	1	0	LAG	AMSK	X	STOR	ISPRAT	-1
1	0	0	0.000	0.000	0.000	-213.	-1	

STAGE	213.00	214.00	215.00	216.00	217.00	218.00	219.00	220.00	221.00	222.00
	223.00	224.00	225.00	226.00						
FLO	0.00	121.00	342.00	624.00	967.00	1352.00	1777.00	2239.00	2736.00	3264.00
	3869.00	4671.00	5743.00	7134.00						

CAPACITY= 0. 147. 340. 1810.
 ELEVATION= 200. 213. 220. 240.

CREL	SPWID	COOW	EXPW	ELEVEL	COOL	CAREA	EXPL
213.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TUPEL COOT DAM DATA
 222.0 0.0 0.0 0.0

PEAK OUTFLOW IS	2154. AT TIME 44.00 HOURS
PEAK OUTFLOW IS	3005. AT TIME 44.50 HOURS
PEAK OUTFLOW IS	4130. AT TIME 44.50 HOURS
PEAK OUTFLOW IS	5343. AT TIME 44.00 HOURS
PEAK OUTFLOW IS	6559. AT TIME 44.00 HOURS
PEAK OUTFLOW IS	7679. AT TIME 44.00 HOURS

SHEET 6

PEAK OUTFLOW IS 8799. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 9913. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 11027. AT TIME 43.50 HOURS

.....

.....

.....

.....

.....

SHEET 7

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND) AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				.20	.30	.40	.50	.60	.70	.80	.90	1.00
HYDROGRAPH AT INFLOW	(	7.50	1	2301.	3451.	4801.	5751.	6902.	8052.	9202.	10352.	11503.
	(	19.42)	(	65.14)	97.72)	130.29)	162.86)	195.43)	228.00)	260.57)	293.15)	325.72)
ROUTED TO OUTFLOW	(	7.50	1	2154.	3065.	4130.	5343.	6559.	7679.	8799.	9913.	11027.
	(	19.42)	(	60.98)	86.79)	116.94)	151.31)	185.73)	217.45)	249.15)	280.72)	312.26)

SHEET 8

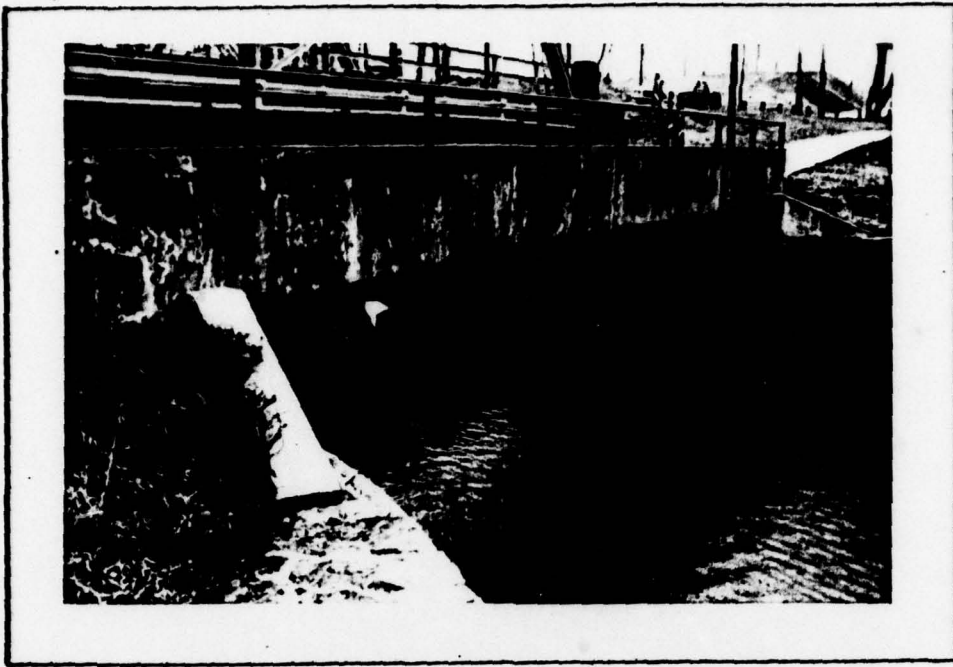
SUMMARY OF DAM SAFETY ANALYSIS

PLAY 1	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 213.00 147. 0.	SPILLWAY CREST 213.00 147. 0.	TOP OF DAM 222.00 532. 3264.					
	MAXIMUM RESERVOIR H.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS		
RATIO OF PMF									
.20	219.52	0.00	384.	2154.	0.00	44.00	0.00		
.30	221.62	0.00	505.	3065.	0.00	44.50	0.00		
.40	223.33	1.23	626.	4130.	5.00	44.50	0.00		
.50	224.63	2.63	719.	5343.	6.50	44.00	0.00		
.60	225.53	3.53	783.	6559.	8.50	44.00	0.00		
.70	226.44	4.44	847.	7679.	10.00	44.00	0.00		
.80	227.35	5.35	912.	8799.	11.50	43.50	0.00		
.90	228.25	6.25	976.	9913.	11.50	43.50	0.00		
1.00	229.15	7.15	1040.	11027.	12.50	43.50	0.00		

APPENDIX

D

Photographs



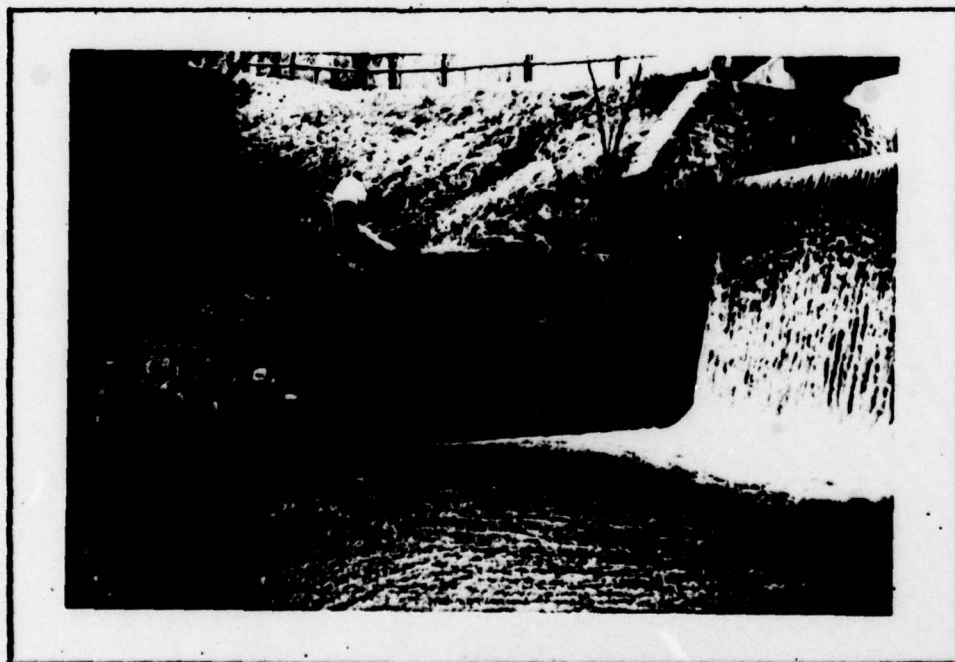
*VIEW OF THE FOOT BRIDGE OVER THE SPILLWAY
WITH THE ROAD BRIDGE IN THE BACKGROUND*



*VIEW OF THE SPILLWAY FROM THE RIGHT ABUTMENT
WHICH IS BENEATH THE ROAD BRIDGE*



***SPILLWAY CREST, RIGHT SIDEWALL, AND FOOT BRIDGE
AS VIEWED FROM THE LEFT SIDEWALL***



***VIEW OF THE RIGHT SIDEWALL OF THE SPILLWAY SHOW-
ING THE ROAD DRAIN PIPE AND THE BRIDGE ABUTMENT***



*DOWNSTREAM MASONRY WALL WITH OVERGROWTH OF
VEGETATION ON THE LEFT SIDE OF THE SPILLWAY OUTLET CHANNEL*



*DOWNSTREAM CHANNEL AND THE EDGE OF THE
DOWNSTREAM APRON OF THE SPILLWAY*



**OUTLET END OF THE RESERVOIR DRAIN PIPE LOCATED
TO THE LEFT OF THE LEFT SPILLWAY SIDEWALL**



**EROSION ALONG THE ROAD DRAIN PIPE
IN THE RIGHT ABUTMENT**

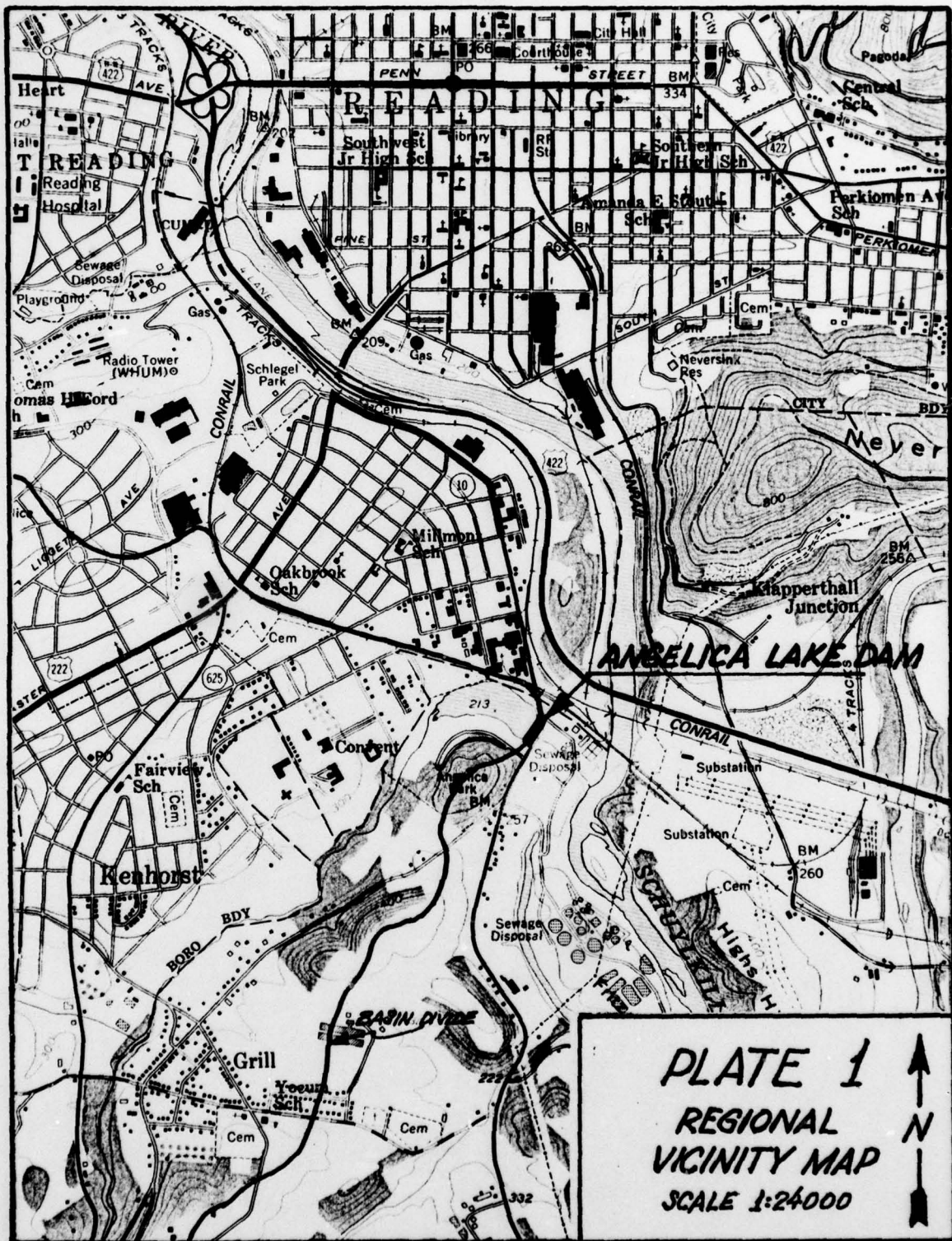
APPENDIX

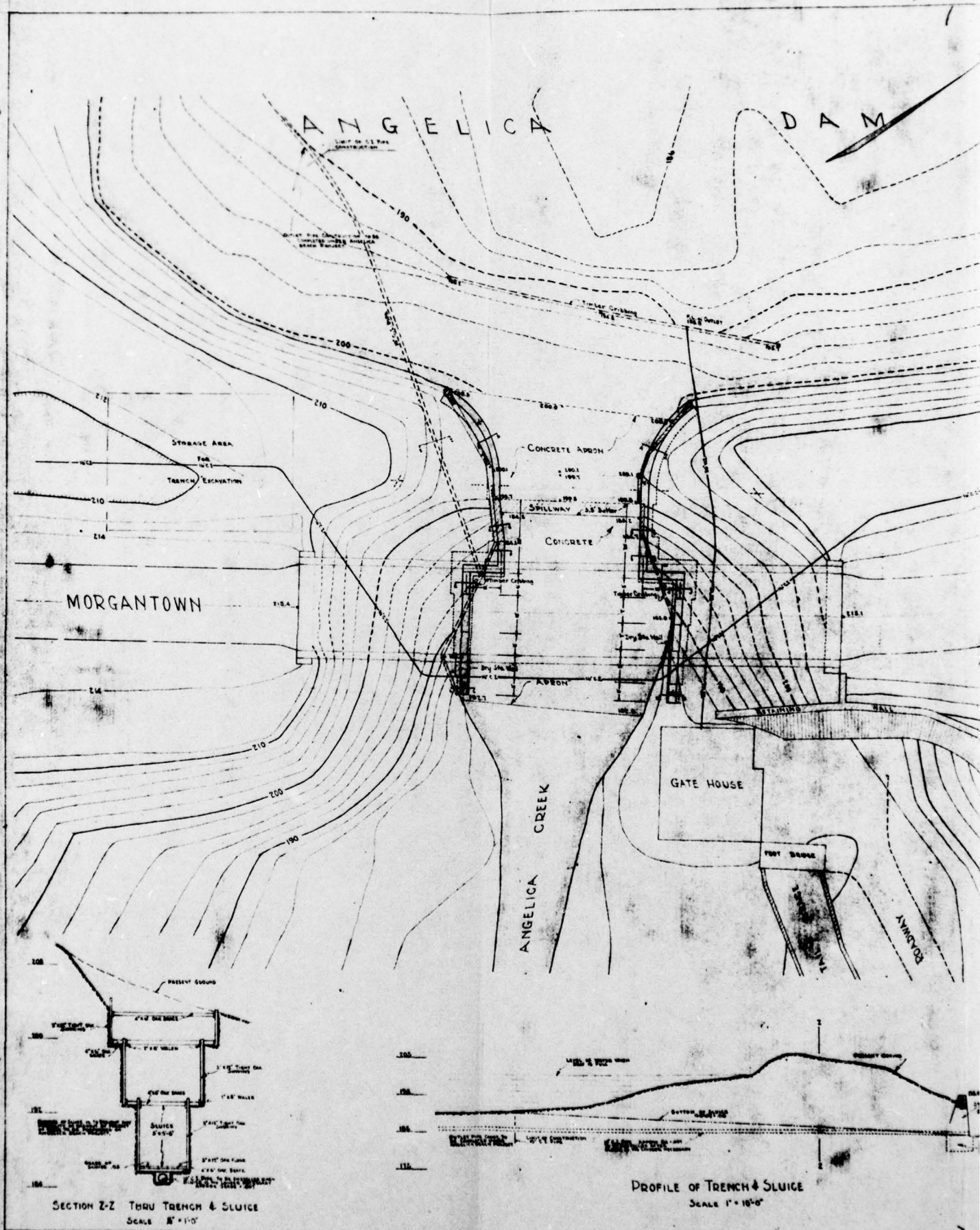
E

Drawings

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REGIONAL VICINITY MAP	PLATE 1
PLAN VIEW	PLATE 2
SPELLWAY SECTIONS	PLATE 3
GENERAL PLAN DRAWING SHOWING PROBLEM AREAS	PLATE 4
PROFILE OF TOP OF DAM @ TIME OF INSPECTION	PLATE 5





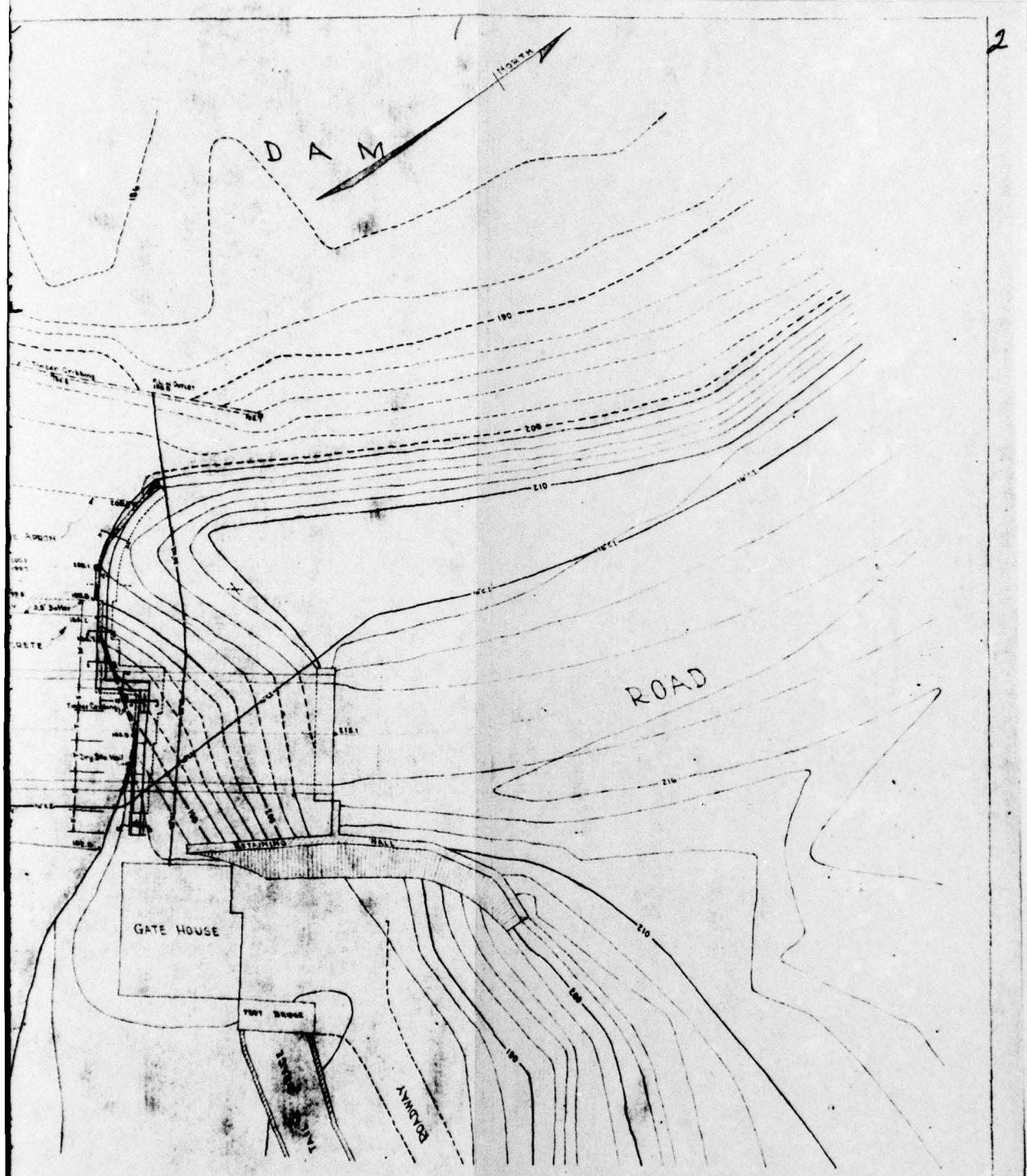


PLATE 2.

CITY OF READING, PA.
DEPT. OF PARKS (PUBLIC PROPERTY)

ANGELICA SPILLWAY
STONE MASONRY
WING WALL CONSTRUCTION
SCALE 1" = 10'-0"

DATE	6/20/54	Director	
DESIGNED BY	C.J.H.	PREPARED BY	BUREAU OF CITY PLANNING
CHECKED BY		DATE	4/20/55
APPROVED BY			City Planning Engr.

PROFILE OF TRENCH & SLUICE
SCALE 1" = 10'-0"



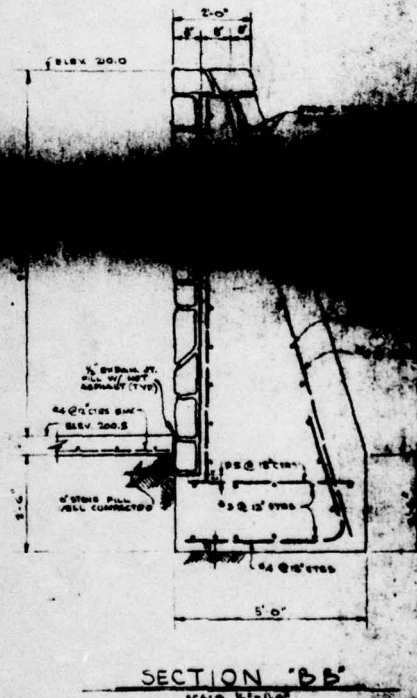
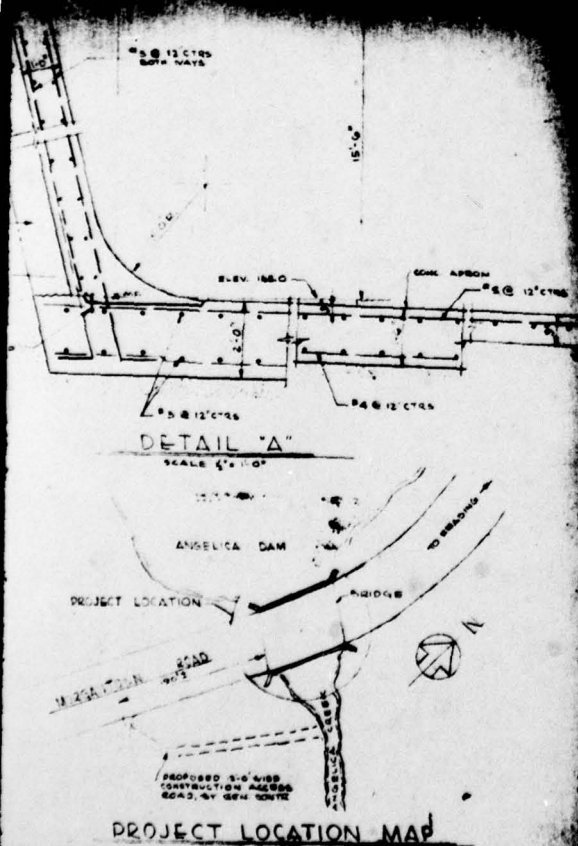
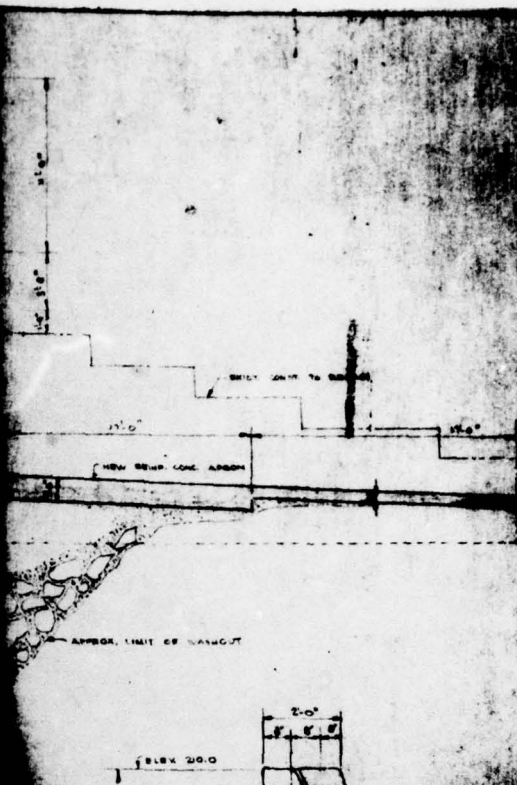
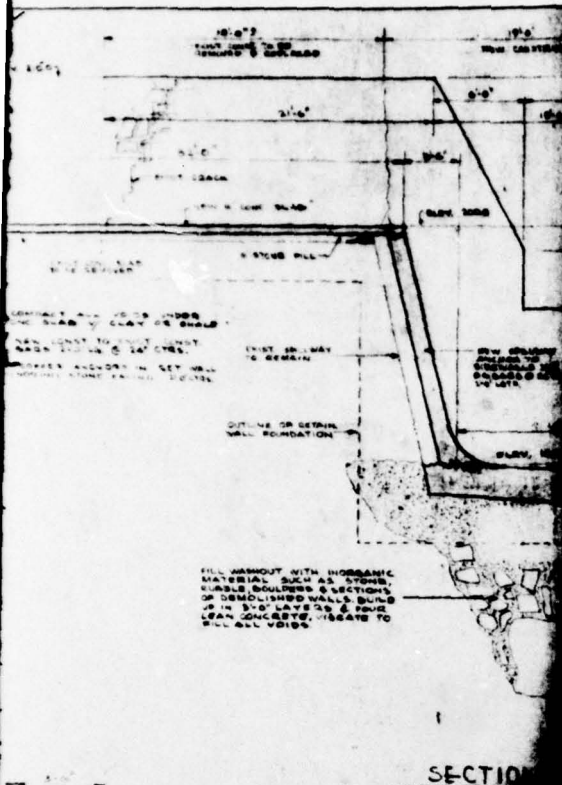


PLATE. 3

APPROVED *[Signature]*

2. DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE

LOCATION	MOSCICA PARK MOSSANTOWN ROAD SEASIDE, PENNA.
SEASIDE	REFRIG. TO BARN PLANT NORTON AUSTIN
DATE	10/1/75
BY	CITY OF SEASIDE Department of Public and Safety

SUBJECT

ANGELICA LAKE DAM

SHEET

BY

RRB

DATE

JOB NO

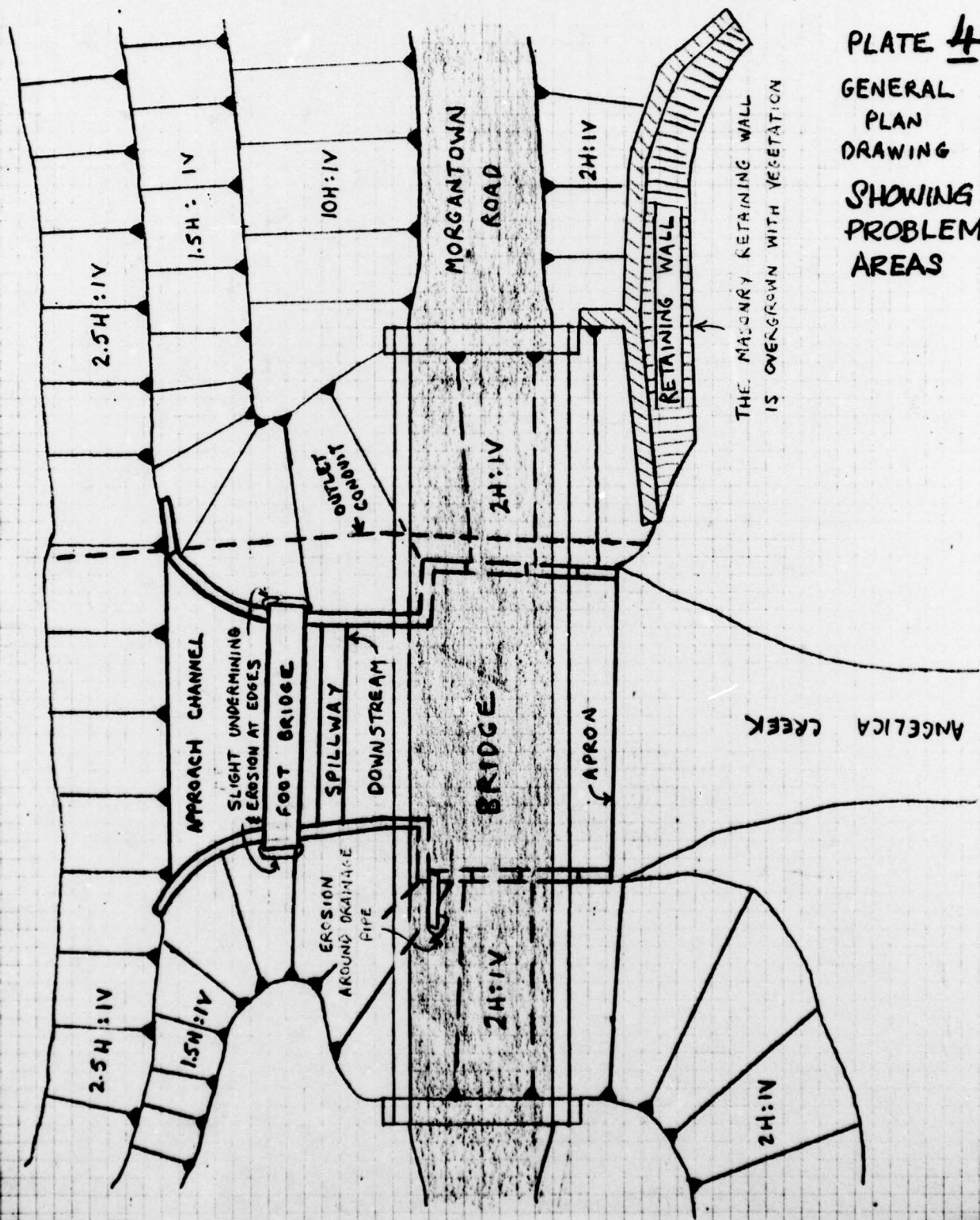


PLATE 4
GENERAL
PLAN
DRAWING
SHOWING
PROBLEM
AREAS



O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT

ANGELICA LAKE DAM

SHEET

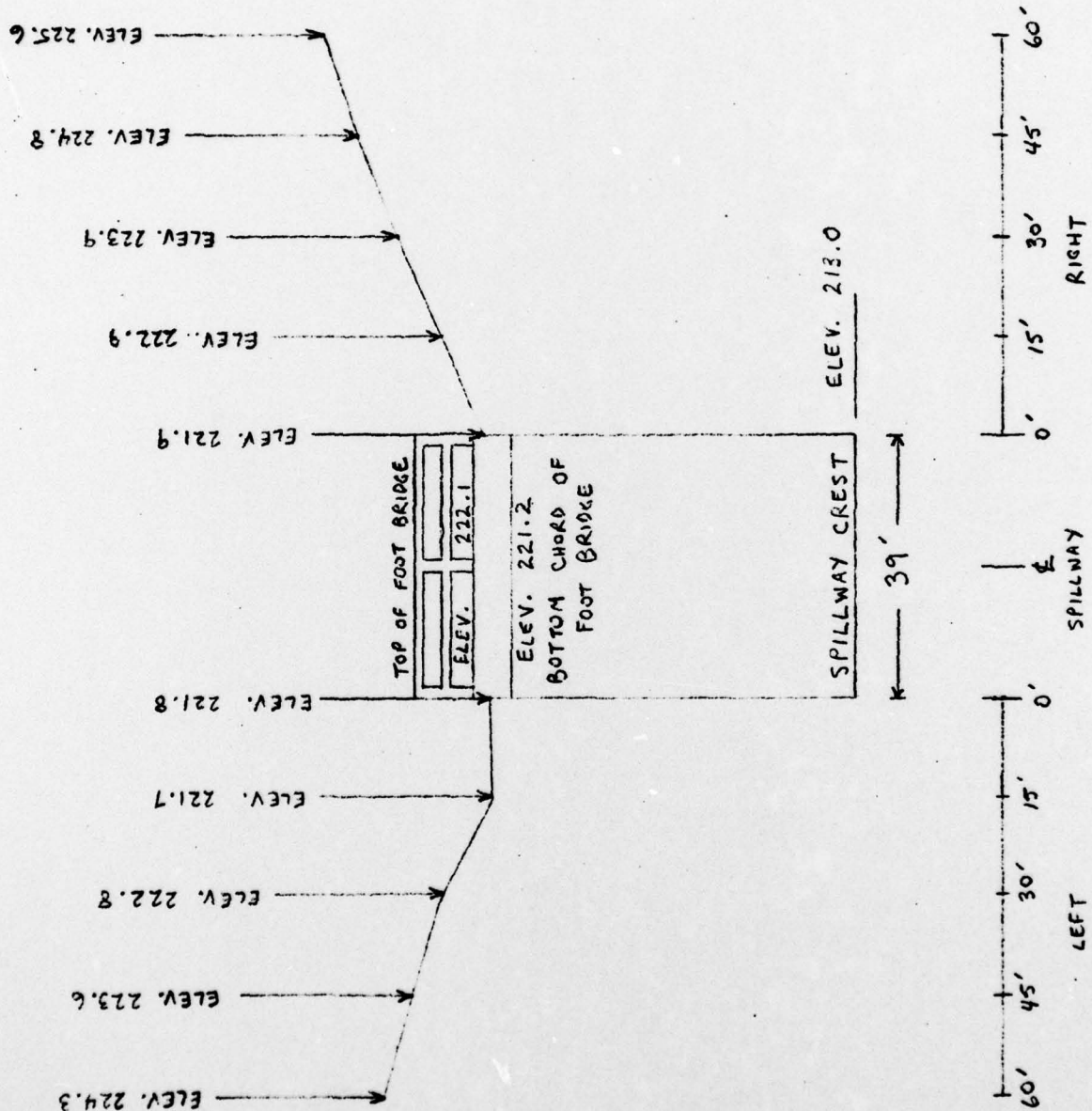
BY

DATE

JOB NO

PLATE 5

PROFILE OF TOP OF DAM



APPENDIX

F

Site Geology

SITE GEOLOGY

ANGELICA LAKE DAM

Angelica Lake Dam is located within the Great Valley section of the Valley and Ridge physiographic province. The two Cambrian rock units underlying the dam are a quartzite of the Hardyston formation and a younger dolomite which is a part of the Leithsville formation. The embankment appears to straddle the conformity between these two formations which parallels the longitudinal axis of the dam. No faults or major structural defects are noted in the vicinity of the dam or lake.

